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Logistic Microdata Model of First-Term Army Reenlistment

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Manpower and Personnel Research Laboratory

U. S. Army
Research Institute for the Behavioral and Social Sciences

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An objective of this study is to analyze the impact of economic incentives such as selective reenlistment bonuses (SRBs) and competitive military pay on the probability to reenlist. Mental category, race, number of dependents, and unemployment are also included in a multinomial logit model. Servicemen eligible to reenlist in 98 Military Occupational Specialties (MOSs) were grouped into 15 career management fields (CMFs) for estimating the logit equations. The results reveal that economic incentives in the form of SRBs and relative pay significantly increase the probability to reenlist in all (continued)

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CMFs. Also, the reenlistment probability is higher among blacks, servicemen with dependents, and individuals with higher mental abilities. The unexpected negative effects of unemployment, although puzzling at first glance, could be attributed to (1) the use of unemployment rate data that are too aggregative to measure local labor market conditions, (2) collinearity of unemployment with civilian wages, and (3) the fact that reenlistment-eligible servicemen are already "employed" and do not view unemployment as a threat.

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FOREWORD

The Manpower and Personnel Policy Research Group of the Army Research Institute (ARI) performs research on the economic aspects of manpower, personnel, and training issues of particular significance to the U.S. Army. This report was prepared as part of ARI's continuing support for the Office of the Deputy Chief of Staff for Personnel.

A major challenge facing the Army is the retention of the quantity and quality of enlisted personnel needed to maintain an experienced force. As the pool of available trained manpower declines, the military must become more competitive in the labor market. Specifically, the Army must understand more precisely the effects of certain factors such as comparable pay, bonuses, unemployment, and demographic characteristics on the probability to reenlist. The research presented in this report quantifies several of the factors thought to affect reenlistment and contributes to the ongoing theoretical and empirical discussion of military manpower modelling.

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LOGISTIC MICRODATA MODEL OF FIRST-TERM ARMY REENLISTMENT

EXECUTIVE SUMMARY

Requirement:

The US Army Research Institute conducts research on manpower, personnel, and training issues of particular significance and interest to the US Army. Recently, economic issues in reenlistment have become extremely important as the Army faces increased competition from the private sector for a declining pool of trained manpower. The authors have examined some economic and demographic variables that affect reenlistment decisions which have a significant impact on the long-term readiness of an experienced Army.

Procedure:

The authors use a multiple regression model to estimate civilian wages of youth aged 19-22 based upon data on education, experience, race, marital status and the number of dependents available from the 1979-81 National Longitudinal Surveys. The estimated civilian wages are used to calculate relative military pay which is an important predictor variable in a logistic microdata model of reenlistment. The other variables of the reenlistment decision include the selective reenlistment bonus (SRB), race, mental category, number of dependents, and unemployment in the home state of record of the enlisted serviceman. A microdata logistic equation was estimated for each of the 15 occupationally homogeneous career management fields (CMF) as well as for the total. This procedure represents a significant improvement over earlier research which yielded results based on ordinary least squares estimation and/or the use of veterans earnings data instead of actual youth wages.

Findings:

The results reveal that economic incentives in the form of SRB and relative pay significantly increase the probability to reenlist in all CMFs. For example, a 10 percent increase in SRB increased the reenlistment probability by 10 percent in CMF 11 (Infantry) and by 21 percent in CMF 91 (Medical and Related Specialities). Similarly, an increase in relative

pay by 10 percent increased the reenlistment probability in CMF 12 (Combat Engineers, Bridge Crewmen, Atomic Demolition Munition Specialities) by 45.4 percent and in CMF 16 (Hercules and Hawk Missile Crew Member, Hercules and Hawk Fire Control Crew Member, ADA Short Range Gunnery Crewmen) by 61.2 percent. We also find the reenlistment probability is higher among blacks, servicemen with dependents, and higher mental category individuals. The unexpected negative effects of unemployment, although puzzling at first glance, could be attributed to (i) the use of unemployment rate data which are too aggregative to measure local labor market conditions, (ii) collinearity of unemployment with civilian wages, and (iii) the fact that the reenlistment-eligible serviceman is already "employed" so that unemployment is actually not viewed as a threat to him.

Utilization of Findings:

This research shows that eligible reenlistees are particularly affected by compensation factors and specifically underscores the desirability of continued attention to military-civilian pay comparability and use of the SRB as a discretionary tool to ensure adequate manning levels in critical MOS.

LOGISTIC MICRODATA MODEL OF FIRST-TERM ARMY REENLISTMENT

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I. INTRODUCTION

The decision of military personnel to reenlist or separate from the armed services at the end of their first-term depends on expected monetary and nonmonetary returns. The latter refer to the taste for the life in the military with its concomitant psychological benefits such as patriotic satisfaction, training, and travel opportunities relative to such disadvantages as loss of independence, risk, and long and unusual working hours. The former consists of wages, allowances, bonuses, and to some extent, perceived retirement benefits. The monetary returns, of course, depend on the so-called 'opportunity costs' of staying in the military -- or the foregone earnings of a civilian employment alternative. If civilian earnings are expected to be greater than the monetary rewards of remaining in the service, personnel are likely to separate, assuming that this earnings differential is not offset by the net nonmonetary returns of military life. The inception of the All-Volunteer Force has made it imperative that the Army pay particular attention to market forces -- particularly the effects of monetary incentives -- in the individual reenlistment decision.

Although the body of military literature on reenlistment is large, the majority of econometric research has been directed toward the Navy (Atwater and Rowe, 1982; Goldberg and Warner, 1982; Kleinman and Shughart, 1974; Warner and Simon, 1979; and Warner, 1981). Relatively little recent attention has been paid to the Army. Daula (1981), however, has pioneered the development of a theoretical framework upon which Daula and Fagan (1982) and Baldwin, Daula, and Fagan (1983) have conducted further empirical analyses.

The purpose of this effort is to build upon the seminal work of Daula **et al.** by isolating the determinants of the reenlistment decision with special attention paid to the selective reenlistment bonus in specific military occupational specialties.

Section II builds a civilian wage model and uses it to estimate potential earnings

available to military personnel in the private sector. In Section III, these estimates are used in constructing and testing an Army reenlistment model. Section IV describes the results of the empirical analysis, while concluding remarks are presented in Section V.

II. THE CIVILIAN WAGE MODEL

In order to present a realistic picture of labor market opportunities that enlisted personnel would face should they choose to leave the Army, their potential civilian earnings were estimated. These were derived from a civilian wage model based on the theory of investment in human capital -- the idea that individuals do not necessarily consume for the sake of present rewards, but invest for the sake of future monetary and non-monetary returns. Individuals will invest today in education and training in anticipation of greater returns later. Earnings of individuals, then, are likely to be depressed during the time they are 'investing in human capital.' This depression in wages, however, is more than offset by higher wages in the later years of their working-life. The parameters to measure the monetary returns on this investment consist of the time spent in acquiring on-the-job training, relevant experience, and education. Blaug (1976) notes that human capital theory predicts that the earnings-experience profiles of different educational cohorts will be concave from below, a prediction that has been widely confirmed. Becker (1975) demonstrated that the age-earnings profiles tend to be steeper among more skilled and educated persons. Psychological theory has told us about 'learning curves', whose declining slope is explained in part by the natural depreciation or obsolescence of human capital. Hence both economic and psychological theories suggest that wages increase as experience and education rise, but the growth rate of wages decreases as human capital deteriorates. Such a concave curve is denoted by a quadratic function in which the natural logarithm of wages is a function of the square of the experience term as the literature suggests.[1] Other factors such as age, race, sex,

and marital status are often included as other explanatory variables in the civilian model of wage determination in order to avoid omitted variable bias.

The estimating equation specified here takes the form

$$(1) \quad W = e^{B_0 + B_1U + B_2E + B_3X + B_4X^2 + B_5R + B_6M + B_7D + u}$$

Taking the natural logarithm of both sides of (1) we obtain

$$(2) \quad \log W = B_0 + B_1U + B_2E + B_3X + B_4X^2 + B_5R + B_6M + B_7D + u$$

where

W = annual wages earned in 1981

U = local area youth (19-24) unemployment rate

E = education (years of formal schooling)

X = weeks of experience

X^2 = X squared

R = race (1 = white; 0 = all others)

M = current marital status (1 = married; 0 = all others)

D = number of dependents

u = random error term

with the expectation that

$$\frac{\delta W}{\delta U} < 0 \; ; \; \frac{\delta W}{\delta E} > 0 \; ; \; \frac{\delta W}{\delta X} > 0 \; ; \; \frac{\delta^2 W}{\delta X^2} < 0 \; ; \; \frac{\delta W}{\delta R} > 0 \; ; \; \frac{\delta W}{\delta M} > 0 \; ; \; \frac{\delta W}{\delta D} > 0$$

Data. The data used are from the 1981 National Longitudinal Surveys of Youth Labor Market Experience (NLS), a national probability sample of approximately 12,000 individuals aged 14-24. For the purposes of this research, we selected from this sample only male respondents in the 19-22 year old range.

We have further limited the sample by excluding those with a four-year college degree, since the comparable enlisted cohort is not likely to have completed college. We have, however, retained those respondents who have completed a two-year college education, since most of the enlistees at the end of their first-term were either high school graduates at the time of enlistment or have since received training/education comparable to a two-year college education. We excluded workers who were also full-time students. An additional limitation was placed on the sample to include only those individuals who worked 35 or more hours a week (the official designation for full-time work) and who earned at least $1,000 in 1981. These restrictions, together with adjustment for missing values, diminished the sample size to 1,837. The descriptive statistics for the relevant variables are shown in Table 1.

Results. The results of the linear, log-linear, and double-log regression equations appear in Table 2. The linear (Eq. 1) specification is used to estimate the 'implicit' civilian wages of existing first-term enlistees, the log-linear (Eq. 2) specification will help test the theory of investment in human capital, while the double-log (Eq. 3) specification (in addition to providing the elasticities directly from the estimating equation) will capture nonlinearities in the model. The implicit civilian wages of first-term Army enlistees can be predicted from the values of the coefficients of the linear equation and the values of such explanatory variables as unemployment, education, experience, race, and the number of dependents of enlistees. These are enlistees' implicit wages because they are imputed from the coefficients of the civilian labor

TABLE 1

DESCRIPTIVE STATISTICS OF THE NLS YOUTH COHORT, AGE 19-22, 1981
(N = 1,837)

Variable	Mean	Minimum Value	Maximum Value	Standard Deviation
Annual Wage ($ 1981)	$11,617	$1,040	$25,000	$4,428
Unemployment Rate (percent)	8.1	4.5	18.0	3.0
Education (years)	11.3	2.0	14.0	1.7
Experience (weeks)	98.4	1.0	313.0	70.2
Race (white = 1)	0.7	0	1.0	0.5
Marital Status (married = 1)	0.3	0	1.0	0.3
Number of Dependents	0.1	0	6.0	0.8

TABLE 2

REGRESSION RESULTS FOR CIVILIAN WAGES OF THE NLS YOUTH COHORT, 1981

Independent Variable	Linear	Log-Linear	Double-Log
Intercept	3,081.65*	13.19*	12.35*
	(3.07)	(154.49)	(74.79)
Unemployment Rate (percent)	-113.56*	-0.01*	-0.1*
	(3.2)	(3.6)	(4.02)
Education (years)	442.58*	0.03*	0.30*
	(6.33)	(5.55)	(5.46)
Experience (weeks)	19.61*	0.01*	0.18*
	(2.59)	(3.19)	(8.83)
Experience-Squared	-0.01	-0.00	
	(0.63)	(1.14)	
Race (white = 1)	527.00*	.05*	0.05*
	(2.14)	(2.46)	(2.66)
Dependents (number)	794.53*	0.07	0.15*
	(6.63)	(6.91)	(7.69)
Adjusted R-Squared	0.12	0.13	0.13
F Ratio	34.02*	35.87*	43.95*
Degrees of Freedom	1,479	1,479	1,480
Durbin-Watson Statistic	1.77	1.79	1.79

t - ratios in parentheses.

*Significant at the .01 level.

market cohort. The log linear specification will validate the theory of human capital discussed above if the coefficient of the experience-squared term is negative and statistically significant.

All coefficients exhibit the expected signs, and all except X^2 are significantly different from zero. The coefficients of determination are typically low (as is generally the case using cross-sectional data), but their F ratios are significant at the .01 level, and the Durbin-Watson statistics indicate absence of autocorrelation of the residuals. The low R^2 can also be attributed to the exclusion of other variables such as occupation and training levels for which data were unavailable. From the linear model we can see that

- A one percent increase in the respondents' local area unemployment rate above the mean level tends to reduce annual wages, on average, by $113.56.
- Each yearly increase in education above the average level increases annual wages by $442.58.
- An increase in experience by one week above its mean tends to increase wages by $19.61 or an increase in experience by one year tends to raise annual wages by $1,020.00.
- On average, annual wages of white workers are $527 higher than that of nonwhites.
- An increase in the number of dependents by one (in excess of the mean number) is associated with an increase of $794.53 in annual wages.
- Minimum earnings in the absence of the above variables is given by the intercept term at $3,081.65.

Marital status (M) is conspicuously absent from the estimating equation because of multicollinearity with the number of dependents (D). We retain the latter since it generally contains the effect of marital status. The X^2 variable has the expected

negative sign but is not statistically significant because of very small variation in the work experience of the 19-22 age cohort. Wages increase as experience gained on the job rises, but at a decreasing rate because of the depreciation of human capital. The double-log specification provides the relevant elasticities. For example, a 10 percent increase in unemployment would result in a 1 percent decrease in wages; a 1 percent increase in education levels will increase wages by 0.3 percent; etc.

In order to estimate civilian wages for enlisted personnel on the verge of their reenlistment decision, the significant coefficients in equation (1) were multiplied by the values of the independent variables for each individual. These were summed together (U was, of course, subtracted) and, combined with the value of the intercept term to obtain the potential civilian wage.[2] These estimates were then used as the denominator of the military-civilian wage variable in the reenlistment model described below.

III. LOGISTIC REENLISTMENT MODEL

For the purposes of this research, the probability to reenlist or quit the Army is considered a discrete bivarate decision. This probability can be denoted by a dependent variable ($R_i = 1$) for reenlistment and ($R_i = 0$) if the individual decides to separate from the Army. This decision is a function of the utility derived by either staying in the Army or by joining the civilian labor market. The utility of reenlisting includes the satisfaction derived from military earnings (i.e. pay and allowances as well as reenlistment bonuses) relative to its opportunity cost of the foregone civilian wage, in addition to other net non-pecuniary benefits of military life such as opportunities to travel, job training, and fulfillment of the partriotic motive. Since the dependent variable has the limited values of 0 or 1, it can best be estimated by a logit or probit model (Maddala, 1983). Pindyck and Rubinfeld (1981) prefer the former and that is the model employed here.[3]

The logit model is based on a cumulative distribution function that can be specified as:

$$(3)\quad R(Y_i = 1, 0) = \frac{1}{1 + e^{-(\alpha + \beta_i X_i)}}$$

where

R = the probability of reenlistment ($Y_i = 1$) or separation ($Y_i = 0$)

e = the base of the natural logarithm

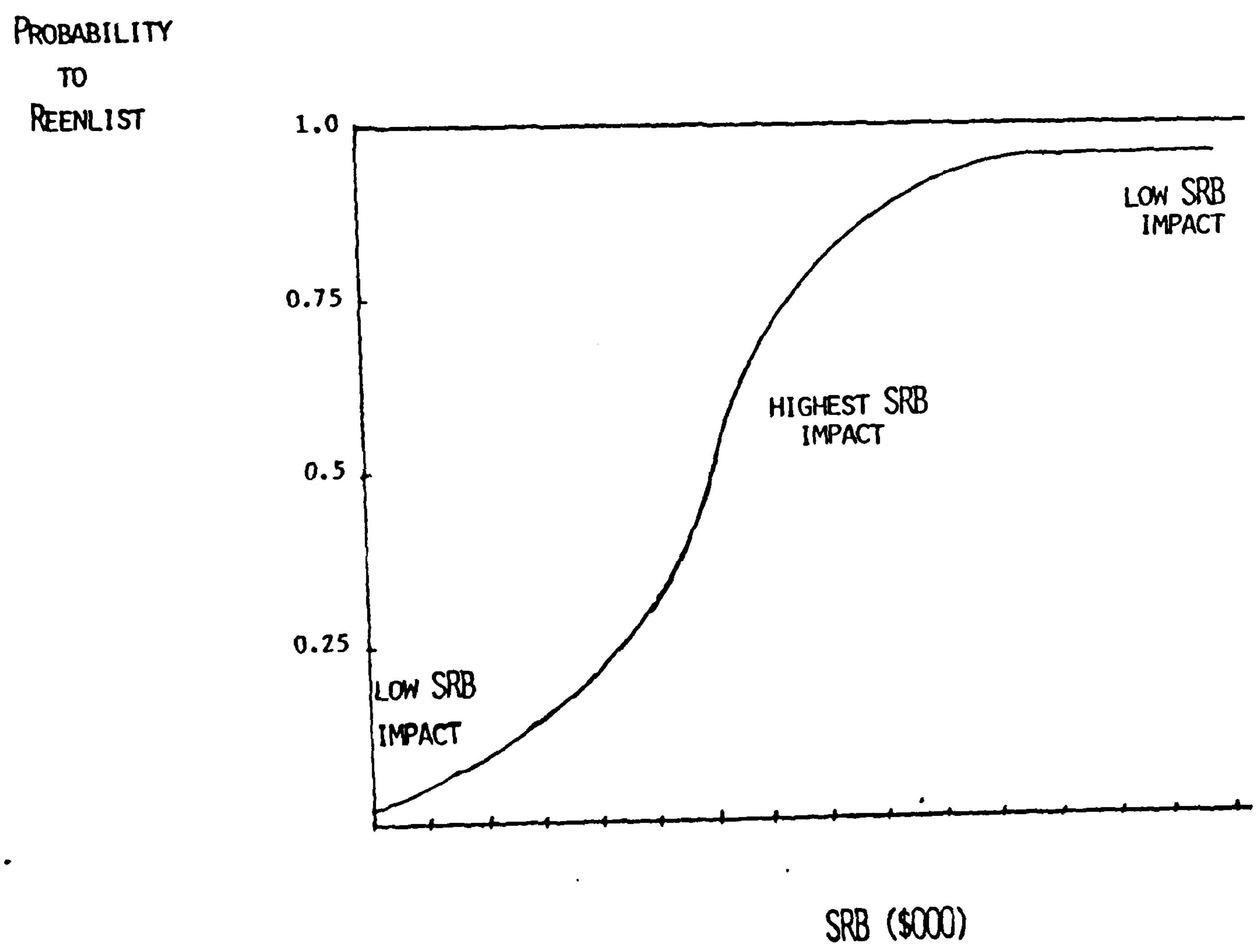
α = intercept parameter

X_i = vector of characteristics of the individual

β_i = coefficients for the X_i's

Equation (3) can be represented by an S-shaped logistic distribution shown in Fig. 1[4] where the cumulative probability to reenlist is shown on the vertical axis and the values of the X_i characteristic (e.g. Selective Reenlistment Bonus -- SRB) are shown on the horizontal axis. The slope of this cumulative distribution is the change in probability with respect to the value of the characteristic. Lakhani (1979) has shown that the slope of β is the maximum at the inflexion point where the probability of reenlistment is .5. An implication of this mathematical property is that a small change in the value of the SRB can bring about a substantial increase in the probability to reenlist. The individuals who are indifferent to reenlistment are likely to have a probability around 0.5 so that they can be influenced considerably by a small change in the SRB. In contrast to these indifferent individuals (on whom SRB policy can have a large impact) are the enlistees at the bottom of the curve who have decided to separate from the Army; very large increases in the SRB are required in order to increase only slightly their probability to reenlist. Similarly, the individuals at the top of the curve have already decided to reenlist; their probabilities of reenlistment are so high that considerable increases in the

FIG. 1: LOGIT FUNCTION FOR IMPACT OF SRB ON REENLISTMENT PROBABILITIES



SRB will result in only *marginal* increases in their probabilities.

Pindyck and Rubinfeld (1981) show that Equation (3) in its structural form can be transformed into the following reduced form model:

$$(4) \quad \ln \frac{R_i}{(1 - R_i)} = \alpha + \Sigma\beta_i X_i + u$$

where

R_i and $(1 - R_i)$ are the probabilities to reenlist and separate, respectively, all other terms are defined as before, and u is the random error term.

Equation (4) can be rewritten in an estimable form as:

$$(5) \quad \ln \frac{R_i}{(1 - R_i)} = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + u_i$$

where

R_i, $(1 - R)_i$, and α are defined as above, and

X_1 = vector of selective reenlistment bonus (SRB) payments in 1981 dollars

X_2 = vector of estimated regular military compensation divided by the estimated civilian wage (RMC/W) in 1981 dollars

X_3 = dummy variable for mental category (CAT), where CAT I-IIIA = 1; 0 = all others

X_4 = dummy variable for RACE, where Black = 1; 0 = all others

X_5 = vector of number of dependents (DEPS)

X_6 = vector of three-month-lagged unemployment rate in the servicemen's home state (U)

β_1 through β_6 = vectors of coefficients for X_1 through X_6

u = vector of error terms

SRB and RMC/W are expected to be positively related to the reenlistment probability since they represent the basic economic incentives provided by the Army. DEPS is also likely to be positively related to reenlistment because servicemen with dependents are likely to be more averse to being geographically repositioned; as a result they are likely to reenlist for present duty assignment, thereby remaining in the same location and within the same MOS. The effect of RACE on reenlistment should also be positive because black enlistees are more likely to remain in the Army than separate and face the possibility of discriminatory treatment in the civilian job market. Likewise, U should be positive since high unemployment can dissuade servicemen from entering the civilian labor market. The impact of CAT on reenlistment cannot be predicted on **a priori** grounds.

Data. Data were obtained primarily from the Enlisted Master File (EMF) for fiscal years 1980 and 1981. A special match of these files determined the number of enlistees who were eligible for reenlistment in FY 1981. Only Zone A reenlistees -- those who decided to reenlist for a period of three to six years and were rated 1, 1A, 1B, 2, 2A, 2B, and 2C -- were included. These ratings signified, among other qualifications, for

example, that servicemen had the required length of service, were tested for their primary MOS, or had a score of 90 or above in any three or more aptitude test areas. Eligible reenlistees were comprised of those who (1) had made the decision to reenlist during the 'open window' period of between 27 and 36 months of service, (2) were in pay grade E3 or higher, and (3) were *qualified in the same* MOS. The reenlistment periods of the eligibles were calculated from the EMF.

In FY 1981, there were over 300 MOS, of which 131 were eligible to receive the first term SRB. In order to reduce the estimable equations to a more manageable number, conserve the degrees of freedom (some MOS are quite small), and provide more variation in the SRB variable itself, the MOS were grouped into 15 Career Management Fields (CMF) as occupationally homogeneous as possible.[5] The data were also sorted to include only those MOS for which a SRB was paid. These MOS are shown, with their corresponding CMF, in Appendix Table 1.

The payment of an SRB is based on three elements of military service. First, it is awarded to only those MOS (skills) that are deemed critical. The degree of criticality is determined by assigning bonus multiples which vary from one (least critical) to six (most critical). These multiples are, in turn, determined periodically by Army management largely on the basis of supply and demand and by the essentiality of a MOS for combat readiness. Second, the final bonus amount varies directly with the size of an individual's monthly basic pay. Third, the bonus also increases with the period of the first-term reenlistment which varies from 3 to 6 years. The amount of the SRB, then, is calculated from the product of the MOS multiple, monthly basic pay, and the years of additional obligated service for each serviceman. The SRB was calculated not only for those who were reenlisting, but also for the eligible separatees, because they had the opportunity to reenlist but decided to separate. The estimation of SRB for separatees was based on the assumption that they would reenlist for an average term in their specific MOS.

Estimates based on actual payments of the SRB for major MOS are shown in Appendix Table 2.

Military pay is denoted by Regular Military Compensation (RMC) and is comprised of basic pay (obtained from individual records in the EMF) to which were added basic allowances for quarters and subsistence, the variable housing allowance, and the federal tax advantage. RMC was adjusted with respect to pay grade, years of service, and marital status. In order to obtain the relative wage variable (RMC/W), RMC was divided by the estimated civilian wage (W) derived from the civilian wage model specified in Section II. The number of dependents (DEP) and the number of individuals classified as CAT I-IIIAs (CAT) were obtained from the EMF.

Unemployment rates by state were obtained from the Bureau of Labor Statistics. The data were obtained for both state of residence at the time of enlistment as well as for the state of last duty station.

The descriptive statistics for these variables are presented in Table 3. The consistently high military wage in the RMC/W variable can be attributed to a 11.7 percent increase in military pay granted in 1981 (Army Forces Journal International, 1984).

IV. EMPIRICAL ANALYSIS

Results. The empirical estimates of the logistic equations, for the 15 CMFs and their total, are reported in Table 4. All equations have a good nonlinear logistic fit as the R^2 values (Domencich and McFadden, 1975) are between .38 to .75, while the most important variables display both the expected signs and statistical significance.

The regression coefficients for SRB in all equations are positive, as expected, and all but one are significant at the .01 level. The coefficients for the relative wage variable (RMC/W) are also positive and significant in most equations. Of those

TABLE 3

DESCRIPTIVE STATISTICS OF THE REENLISTMENT VARIABLES BY CMF, FY 1981

Number	CMF	Number Qualified to Reenlist	Number Reenlisted	SRB (Average)	RMC/W	CAT (Percent I-IIIA)	RACE (Percent Black)	DEPS (Percent with Dependents)	U (Average Home State Unemployment Rate)[1]
1	Total	28,16.	5,887	$3,553	1.09	18	30	63	6.4
2	11	6,963	1,639	4,459	1.09	19	33	63	6.2
3	12	1,895	245	4,839	1.10	8	19	48	6.6
4	13	3,520	1,001	3,979	1.09	19	43	71	6.5
5	16	934	212	2,498	1.07	12	48	61	6.5
6	19	2,863	546	3,972	1.11	19	24	62	6.4
7	23	171	25	5,302	1.08	14	21	67	6.7
8	27	252	48	4,136	1.10	19	27	52	6.8
9	28	67	26	4,310	1.08	39	15	98	6.4
10	29	513	112	3,161	1.09	27	21	62	6.5
11	31	2,179	453	2,382	1.07	13	46	65	6.3
12	63	4,287	653	2,251	1.10	13	23	62	6.6
13	64	303	106	3,903	1.08	44	16	86	6.7
14	91	2,858	523	2,718	1.08	22	27	66	6.5
15	96	328	80	3,879	1.09	31	11	56	6.6
16	98	1,028	218	4,847	1.10	31	13	54	6.6

[1] This represents the average of the unemployment rate of the states in which eligibles in each CMF lived.

Source: Defense Manpower Data Center, Enlisted Master File, FY 1980 - FY 1981; National Longitudinal Surveys, 1982; and Bureau of Labor Statistics, 1981.

TABLE 4

LOGISTIC REGRESSIONS FOR REENLISTMENT PROBABILITIES FOR CMF, FY 1981
(Chi-square Statistics are in Parentheses)

Equation	CMF	R^2	Intercept	SRB	RMC/W	CAT	RACE	DEPS	U
				Explanatory Variables					
1	Total	.45	-10.72*	0.00021*	6.99*	2.02*	1.26*	0.77*	-0.09*
			(832.21)	(757.28)	(438.27)	(2882.54)	(1034.03)	(934.49)	(161.30)
2	11	.42	-15.35*	0.00028*	11.04*	1.86*	1.34*	0.91*	-0.13*
			(355.37)	(262.26)	(234.65)	(630.58)	(314.47)	(308.1)	(95.52)
3	12	.54	-9.10*	0.00019*	4.75*	3.03*	1.66*	0.72*	-0.06*
			(39.46)	(42.43)	(13.6)	(196.76)	(73.06)	(45.1)	(4.14)
4	13	.49	-14.24*	0.00040*	9.63*	1.76*	1.39*	0.93*	-0.10*
			(190.90)	(300.09)	(109.33)	(264.68)	(185.34)	(179.57)	(31.60)
5	16	.38	-11.53*	0.00004*	7.43*	1.76*	1.1*	0.82*	-0.03
			(39.7)	(16.84)	(20.95)	(58.41)	(28.75)	(43.69)	(1.11)
6	19	.46	-12.25*	0.00004*	7.62*	2.05*	1.37*	0.79*	-0.09*
			(78.41)	(133.25)	(37.83)	(273.0)	(97.32)	(71.73)	(17.29)
7	23	.75	-1.65	0.00002	-1.94	6.64*	2.53*	1.03	-0.58*
			(0.05)	(2.82)	(0.08)	(20.28)	(5.14)	(3.09)	(8.54)
8	27	.52	-13.32*	0.00004*	8.64**	2.42*	0.8	1.0*	-0.18*
			(6.57)	(12.36)	(3.41)	(28.54)	(2.49)	(7.33)	(5.17)
9	28	.71	-20.65	0.00076*	15.62	5.51*	3.09*	1.93*	-0.80*
			(2.94)	(9.18)	(2.15)	(13.04)	(4.18)	(5.88)	(6.94)
10	29	.62	-8.68*	0.00031*	3.97	3.38*	2.06*	0.25	-0.03
			(6.82)	(26.72)	(1.74)	(102.17)	(27.92)	(1.32)	(0.25)

TABLE 4 (Continued)

LOGISTIC REGRESSIONS FOR REENLISTMENT PROBABILITIES FOR CMF, FY 1981
(Chi-square Statistics are in Parentheses)

				Explanatory Variables					
Equation	CMF	R^2	Intercept	SRB	RMC/W	CAT	RACE	DEPS	U
11	31	.51	-12.89* (79.72)	0.00100* (149.49)	7.18* (29.52)	1.85* (133.32)	1.16* (63.87)	0.76* (62.99)	0.07* (6.13)
12	63	.41	-11.96* (139.65)	0.00028* (157.32)	8.10* (81.53)	1.68* (228.03)	1.09* (85.69)	0.95* (182.81)	-0.11* (33.94)
13	64	.66	-2.77 (0.51)	0.00022* (10.95)	-0.69 (0.04)	3.57* (67.90)	1.17* (5.35)	0.75* (7.93)	-0.12 (2.30)
14	91	.60	-6.20* (24.10)	0.00096* (201.89)	0.61 (0.28)	2.85* (438.81)	1.02* (49.06)	0.30* (13.16)	-0.03 (1.60)
15	96	.65	-14.48* (17.24)	0.00005* (19.96)	9.71* (10.29)	3.89* (66.3)	2.89* (20.53)	0.75* (11.76)	-0.3* (14.23)
16	98	.65	-5.02* (11.49)	0.00009* (13.88)	0.81 (0.39)	3.77* (237.40)	0.46 (2.35)	0.33* (5.84)	0.01 (0.00)

*Significant at the .01 level.

**Significant at the .05 level.

coefficients for which we obtained the wrong signs, none is significantly different from zero. An increase, then' in military compensation -- either in terms of pay or bonuses -- will increase individuals' probability to reenlist.

The positive and significant values for CAT in all 16 equations indicate that an increase in the number of the enlistees in mental catagories I to IIIA will, other things being equal, tend to increase the overall probability to reenlist. The conventional negative relationship between mental category and reenlistment is the result of a total (simple) correlation, and is not to be confused with the partial correlation coefficient reported here. The partial correlation assumes that the effects of other explanatory variables in the equation are held constant and shows the effect of CAT only. We estimated the total correlation coefficients and found them to be negative as expected. The sign of the RACE variable is also positive in all equations; most of the coefficients are significant. Black enlistees will tend to reenlist at a greater rate than their white counterparts. The relationship between the number of dependents (DEPS) and reenlistment probabilities is also positive and significant in nearly all equations. Enlistees with dependents are more likely to reenlist than single service personnel.

The only unexpected results are for unemployment. These persisted when we employed alternative lag structures on the variable, and also when we used the unemployment rate of both the enlistee's duty station and home state. The reasons for this result are two-fold. First, state unemployment rates are probably too aggregate a statistic to measure local labor market conditions in the occupations that these servicemen are likely to select. Second, the effect of unemployment is also captured in the civilian wage variable (both unemployment and wage rates are indicators of civilian job market prospects) so that collinearity among these variables probably masks to some extent the unemployment effect. Furthermore, service personnel at the reenlistment decision point are, of course, already 'employed,' so that unemployment is actually not a

threat to them.

Similar unemployment effects were reported by Baldwin, Daula and Fagan (1983, Version B, Appendix C). Daula and Fagan, (1982) found an insignificant unemployment impact, noting that "the lack of precision in this estimate may be due to .... the complexity of [the] model; the crudeness of our measure of unemployment, or multicollinearity with the race variable" (p. 27).

In order to adjust for the collinearity between unemployment and wages, we eliminated the unemployment variable and reestimated the 16 equations. The results (Appendix Table 3) revealed that there was no significant change from the earlier estimates which included unemployment, indicating considerable stability and robustness in the model. Stability of the model was tested further by reducing several observations and reestimating the equations. No significant changes in the signs or sizes of the coefficients took place as a result of these changes.

In order to determine the impact of all factors -- particularly key policy variables such as SRB and military pay -- on the probability to reenlist, **elasticities** are calculated (Table 5).[6] Statistically significant SRB elasticities vary widely -- from .13 for CMF 19 to 2.14 for CMF 91. Pay elasticities are in the range 4.54 to 9.26. The effects of a 10-percent increase in SRB and RMC/W on reenlistment probabilities are reported in Table 6.

For all CMFs together, the SRB elasticity of .59 implies that a 10-percent increase in the SRB over its average value of $3,553 (from Table 3) will tend to increase the probability to reenlist by 5.9 percent over its mean probability of .21 -- that is, by .012 to .222 (.21 X 105.9/100). With an increase in the SRB of about $350, then, an additional 365 individuals would reenlist. For CMF 11, a 10-percent increase in the SRB over its mean value of $4,459, (about $450) will tend to increase the reenlistment probability by 9.6 percent. The average reenlistment probability will increase, then, from .23 to .252.

TABLE 5

REENLISTMENT PROBABILITIES AND ELASTICITIES BY CMF, FY 1981

			Elasticities					
Equation	CMF	Reenlistment Probability	SRB	RMC/W	CAT	RACE	DEPS	U
1	Total	.21	.59	6.02	.3	.3	.4	-.4
2	11	.23	.96	9.26	.3	.3	.4	-.6
3	12	.13	.80	4.54	.2	.3	.3	-.3
4	13	.29	1.13	7.45	.2	.4	.1	-.5
5	16	.23	.77	6.12	.2	.4	.4	#
6	19	.19	.13	6.85	.3	.3	.4	-1.5
7	23	.15	#	#	.8	.5	#	-3.2
8	27	.19	.13	7.69	.4	#	.4	-1.0
9	28	.39	1.84	#	1.3	.3	1.1	-3.1
10	29	.22	.74	#	2.4	.3	#	#
11	31	.21	1.89	6.08	.2	.4	.4	-.3
12	63	.15	.54	7.55	.2	.2	.9	-.6
13	64	.35	.56	#	1.0	.1	.4	#
14	91	.18	2.14	#	.5	.2	.2	#
15	96	.24	.15	8.04	.9	.2	.3	-1.5
16	98	.21	.34	#	.9	#	.1	#

= Not significant.

TABLE 6

FFECT OF 10 PERCENT INCREASE IN SRB AND RELATIVE PAY ON REENLISTMENT PROBABILITIES

Equation	CMF	Average Reenlistment Probability	Average SRB	SRB Elasticity	Reenlistment Probability (10% SRB Increase)	RMC/W Elasticity	Reenlistment Probability (10% Pay Increase)
1	Total	.21	$3,553	.59	.222	6.02	.336
2	11	.23	4,459	.96	.252	9.26	.443
3	12	.13	4,839	.80	.140	4.54	.189
4	13	.29	3,979	1.13	.323	7.45	.506
5	16	.23	2,498	.77	.247	6.12	.371
6	19	.19	3,972	.13	.192	6.85	.320
7	23	.15	5,302	#	-	#	-
8	27	.19	4,136	.13	.992	7.69	.336
9	28	.39	4,310	1.84	.462	#	-
10	29	.22	3,161	.74	.236	#	-
11	31	.21	2,382	1.89	.249	6.08	.337
12	63	.15	2,251	.54	.158	7.55	.263
13	64	.35	3,903	.56	.370	#	-
14	91	.18	2,718	2.14	.219	#	-
15	96	.24	3,879	.15	.244	8.04	.433
16	98	.21	4,847	.34	.217	#	-

= Not Significant.

It must be noted that the relatively small responsiveness of reenlistment to SRB increases in this CMF is due to its location (low probability) on the lower tail of the S-shaped logistic curve (Figure 1). A considerable change in SRB is required to bring about even a small change in reenlistment probabilities.

The relative wage (RMC/W) elasticity for all CMFs together indicates that a 10-percent *increase* in military relative to civilian pay will tend to increase the mean reenlistment probability by 6 percent. Hence the mean reenlistment probability will increase from .21 to .336. The relative wage elasticity for CMF 11, however, is 9.26. Hence, a 10-percent increase in the relative wage ratio for that CMF will increase the mean reenlistment probability from 0.23 to .443.

One would expect that the SRB elasticities would be larger for those occupations which are not easily transferable to the private sector or are less technical in nature. Likewise, elasticities should be smaller for occupations characterized by skills which are more technical and in demand in the civilian labor market or are risky and dangerous. The results conform to **a priori** expectations. High elasticities are observed for non-transferable occupations in field artillery (CMF 13) and less technical occupations as general mechanics and repairers (CMF 28), operators (CMF 31), and general maintenance (CMF 91). Lower elasticities are found among the more technical occupations with high civilian demand (electronics-related occupations as in CMFs 27, 29, 63, 96, and 98) and those combat occupations that are risky and dangerous (CMF 12, 16, and 19).

Comparisons With Previous Work. A comparison of results of the present work with other reenlistment studies is presented in Table 7. Unfortunately, it is difficult to make precise comparisons of these results since the studies differ in time period analyzed, variables included, models used and equations specified, as well as service branch and occupations considered. Nonetheless, it is possible from examining the elasticities in the

TABLE 7

COMPARISON OF FIRST TERM REENLISTMENT ELASTICITIES IN 13 STUDIES

No.	Author(s)	Military Branch (Occupations)	Model	Data Period	Elasticities For: SRB	RMC/W	CAT	RACE	DEPS	U	EP
1	Daula (1981)	Army (Infantry)	MLE (micro data)	1976-80	-	.14[1]	-	.26	.43	.02	.28
		Army (Infantry)	Probit (micro data)	1976-80	-	.64[1]	-	-.12	.17	2.86	-
2	Daula-Fagan (1982	Army (Infantry)	MLE (micro data)	1976-80	-	-5.67[1]	-	-.82	-	-	.41
			MLE (micro data)	1976-80	-	-	-	.21	.28	.004	.33
3	Baldwin-Daula-Fagan (1982)	Army (Infantry)	Probit (micro data)	1976-80	-	.18[1]	-	.23	.34	.01	.31
4	Baldwin Daula-Fagan (1983)	Army (Infantry)	FIMLE (micro data)	1973-76	-	2.9[1] .24[1]	-	-2.24 .18	.011 .26	-.008 .002	2.17 .34
5	Lenius et al. (1982)	Army (10 Occupations)	Ordinary Least Squares	1976-80	-.022 to .062	-.066	-	-	-	-2.413 to 3.583	-

TABLE 7 (Continued)

COMPARISON OF FIRST TERM REENLISTMENT ELASTICITIES IN 13 STUDIES

No.	Author(s)	Military Branch (Occupations)	Model	Data Period	Elasticities For: SRB	RMC/W	CAT	RACE	DEPS	U	EP
6	Bowman-Thomas (1982)	Air Force (8 (Occupations)	Logit (grouped data)	1972-75	-	2.95[1]	-.04	-.19	-	-	-
7	Atwater-Rowe (1982)	Navy (3 Occupations)	Probit (grouped data)	1978-80	-.02	-	-	-	-	-	-
8	Goldberg-Warner (1982)	Navy (9 Occupations)	Logit (micro data)	1974-80	.02 to .039	.003 to .004	-	-	-	.019 to .066	-
9	Enns (1977)	Army	Log-Logit (grouped data)	1971 1972 1973	.09 - -	- - -	.22 - -	.74 .39 .46	- 1.3 1.6	- - -	- - -
10	Warner-Simon (1979)	Navy	Probit (micro data)	1974-78	-	1.7 to 5.1[3]	-	-	-	-	-
11	Rodney (1980)	Navy	Ordinary Least Squares	1973-79	-	2.36	-	-	-	-	-

TABLE 7 (Continued)

COMPARISON OF FIRST TERM REENLSITMENT ELASTICITIES IN 13 STUDIES

No.	Author(s)	Military Branch (Occupations)	Model	Data Period	Elasticities For: SRB	RMC/W	CAT	RACE	DEPS	U	EP
12	Kleinman-Shughart (1974)	Navy	Logit (grouped data)	1965-67 1968-69 1971-72	2.20 to 4.24	-	-	-	-	-	-
13	This Study	Army (15 CMFs)	Logit (micro data)	1981	.13 to 2.14	4.54 to 9.26	.2 to 1.0	.1 to .5	.1 to .9	-3.2 to -.3	-

[1]SRB included in the wage variable.

[2]RMC refers to military pay only; civilian wage is a separate variable.

[3]Refers to annualized value of military compensation deflated by CPI.

[4]Regression coefficients, not elasticities.

MLE = Maximum Likelihood Estimates.

FIMLE = Full Information Maximum Likelihood Estimates.

literature to obtain a sense of relative importance of some of the more significant factors affecting military reenlistment rates.

The effects of SRB on reenlistment are estimated separately in only four other studies -- Atwater and Rowe (-.02) and Goldberg and Warner (.02 to .039) for the Navy, and Enns (.09) and Lenius **et al.** (-.022 to .062) for the Army. The effects reported are very low compared to the present work where SRB elasticities range from .13 to 2.14. Negative signs in other studies are counterintuitive, of course, since they imply that servicemen are willing to accept pay reductions to continue in the Army. The Early Promotion variable (EP) reported in Table 7 is used by Daula **et al.** as a proxy for SRB. As expected, its effect is positive and significant.

Nearly half of the studies include SRB in their military-civilian pay variable (RMC/W). The effect of pay, however, (whether or not SRB is included) varies widely, but nearly all studies report positive effects, showing the importance of pecuniary factors in the reenlistment decision.[7] The four studies by Daula **et al.** report pay elasticities in the range -5.67 to .64. While the negative values are difficult to explain, their positive values are relatively low. The relatively high pay elasticities in our study are due to two major reasons. First, the variation in military pay in our cross-sectional model is due to variation in paygrade and not due to annual changes in pay, as in other studies using time-series data. Second, the denominator in our pay variable is estimated from the NLS youth cohort data. These wages are likely to be lower and more realistic, since they pertain specifically to youth; other studies use such proxies as the average wages of production workers (which include all age groups) or the earnings of veterans (which include officers).

The CAT elasticity is available in only the Bowman-Thomas study (at -.04) for the Air Force and the Enns study (between -.39 and .74) for the Army. Enns' positive responses are consistent with our findings; the 1973 result is the first year of the

All-Volunteer Force.

Unexpected negative signs of the RACE variable are observed in four studies -- Daula (1981, Table 5-10), Daula and Fagan (1982, Table 6), Baldwin, Daula, and Fagan (1983, Table 3) and Bowman and Thomas (1982). This can be explained, perhaps, by the interaction of the race-adjusted unemployment rate used to explain civilian wages. Our estimates of these elasticities are positive, as expected, the range of which includes the positive estimates of Daula (1981, Table 5-15) and Baldwin, Daula and Fagan (1982, Table 5). Black servicemen tend to reenlist at greater rates than white soldiers.

The signs of the DEP variable are uniformly positive in all the studies, with most estimates well within the range reported in the present work. Soldiers with dependents are more likely to reenlist than their single counterparts.

The signs of the unemployment effect are generally positive in the 7 Army and 1 Navy studies that included this variable. The size of the elasticities, however, varies widely.

V. CONCLUSIONS

This research has attempted to measure the relative significance of economic and related factors to the individual reenlistment decision. The primary finding is the positive and significant impact of economic incentives. We find that an increase in selective reenlistment bonus payments of 10 percent in CMF 11, for example, would increase the probability of reenlistment from .23 to .252, or 36 more reenlistees. Alternatively, an increase of 10 percent in military relative to civilian pay would increase the reenlistment probability in CMF 11 from .23 to .443, or 349 new reenlistees. We also observe considerable variation in these elasticities by occupations. The occupations that are risky, technical and/or in high civilian demand tend to have low reenlistment elasticities; those that are less technical and, hence, less transferable to

the civilian sector tend to have higher reenlistment elasticities.

The significantly positive relationship of the mental category variable with reenlistment suggests CAT I-IIIAs reenlist at a greater rate than do others. Blacks have a higher reenlistment probability than do whites. We also find that soldiers with dependents reenlist at a greater rate than their single counterparts.

Future reenlistment research will proceed in at least three directions. First, servicemen who extend their terms for less than three years do not qualify for the SRB, but can change force structure by making it more experienced. The increased experience can change their tastes for Army life which, in turn, can alter future reenlistment rates. These decisions will be analyzed in a trichotomous multinomial logit model. Second, the cross-section analysis for FY 1981 can be extended to include other years in a pooled cross-section time-series framework. Such an extension will include periods when the SRB was paid in lump sum as well as in installments so that the elasticities for these alternative policies can be evaluated by the Army and a policy formulated on the payment of lump sum versus installment. The lump sum versus installment bonus can also help estimate personal discount rates of enlisted sevicemen. Third, the demand side can be incorporated in terms of a mathematical programming model with an objective function of satisfying the demand in critical MOS subject to SRB budget constraints.

NOTES

[1]See, for example, Mincer (1974), Heckman and Polachek (1976), Cooper (1981), and Goldberg and Warner (1983).

[2]Experience square (X^2) was not used for estimating the implicit civilian wages because it was not significant.

[3]Although Pindyck and Rubinfeld note that logit and probit models employ the *maximum likelihood* estimation technique, they prefer the logit model because of its desirable econometric properties. Specifically, they argue that "Because it is possible to prove that a *unique maximum always* exists for the logit model, maximum-likelihood estimation is particularly appealing. Almost any nonlinear estimation routine will find the estimated parameters; the only question is one of computing costs. It is possible to prove that the maximum-likelihood estimation technique yields consistent parameter estimates, and the calculation of the appropriate large-sample statistics is not difficult" (p. 294). In his probit model, Daula (1981) noted that his "results are only illustrative and are not ML results **since a maximum was never reached**" (Table 5-16, p. 5-34, emphasis supplied). The cost of estimation has dropped considerably since the availability of such efficient software as the SAS *Logist* program used in our study (See Dale, 1983).

[4]These S-shaped growth curves have been widely used in the analysis of market penetration of new products or technologies. In these models, the cumulative probability of market penetration is represented on the vertical axis and time is shown on the horizontal axis so that the growth rate of penetration (given by the slope of the S-shaped curve) is slow in the initial phase, accelerates in the intermediate phase, and decelerates in the final phase. Such models were used by Grilliches (1957) for hybrid corn; Bain

(1964) for televisions; Chow (1967) for computers; Mansfield (1975) for several manufactured products; and Lakhani for petroleum refining (1975) and coal mining (1980, 1982).

[5] Of the 131 MOS eligible to receive the SRB, we selected only those MOS which met the following criteria: (a) at least two MOS were to comprise a CMF, and (b) the SRB payment totaled more than $500,000.

[6] Since the SRB amount was paid as a lump-sum at the time of reenlistment (rather than spread out over the reenlistment period) it was not necessary to discount the SRB amounts to their present values.

[7] The elasticity is given by the product of the Beta coefficient, the probability to separate from the Army, and the average value of the variable. See Appendix A.

[8] Zulli (1980) discussed problems of comparability of results from Navy studies with respect to pay elasticities, and concluded that "... the overall range for first term reenlistments is from 2 to 4 for all-Navy models *during the draft era and from* 1.0 to 3.0 ... in the AVF era" (p. 37).

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APPENDIX A

ELASTICITY IN A LOGISTIC DISTRIBUTION

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ELASTICITY IN A LOGISTIC DISTRIBUTION

The concept of elasticity is important since it measures the sensitivity of the dependent variable -- in this case the reenlistment probability -- to changes in the values of various independent variables. It is defined as the percentage change in the probability to reenlist in response to a one percent change in military pay, selective reenlistment bonus, etc., and is given by:

$$(1) \quad \frac{\partial R}{\partial X_i} \cdot \frac{\bar{X}_i}{\bar{R}_i}$$

Where ∂R = change in probability to reenlist:

∂X_i = change in X_i;

$\bar{X}$ = mean value of X_i;

$\bar{R}$ = mean reenlistment rate.

Equation (1) can be evaluated by first obtaining the value of $\frac{\partial R}{\partial X}$ and multiplying by $\bar{X}_i / \bar{R}_i$. Recall the logistic function as:

$$(2) \quad R = \frac{1}{1 + e^{-(\alpha + \beta X_i)}} = \frac{1}{(1 + e^{-z})}$$

Where $(\alpha + \beta X) = z$

Multiplying both sides of Equation (2) by $(1 + e^{-z})$ we obtain:

$$(3)\quad R\,(1 + e^{-z}) = 1$$

Therefore:

$$(4)\quad \frac{1}{R} = 1 + e^{-z} \text{ and hence}$$

$$(5)\quad e^{z} = \frac{R}{(1 - R)}, \text{ or}$$

$$(6)\quad R = (1 - R)\,e^{z}$$

$$= (1 - R)\,e^{\alpha + \beta X}$$

Simplifying the Right Hand Side, we obtain:

$$(7)\quad R = e^{\alpha + \beta X} - Re^{\alpha + \beta X}$$

Transposing and simplifying:

$$(8)\quad R + Re^{\alpha + \beta X} = e^{\alpha + \beta X}$$

$$(9)\quad R\,(1 + e^{\alpha + \beta X}) = e^{\alpha + \beta X}$$

$$(10)\quad R = \frac{e^{\alpha + \beta X}}{1 + e^{\alpha + \beta X}}$$

$$(11)\quad \frac{\partial R}{\partial X} = \frac{(\beta e^{\alpha + \beta X})(1 + e^{\alpha + \beta X}) - (\beta e^{\alpha + \beta X})(e^{\alpha + \beta X})}{[1 + e^{\alpha + \beta X}]^2}$$

$$= \frac{\beta e^{\alpha + \beta X}[1 + e^{\alpha + \beta X} - e^{\alpha + \beta X}]}{[1 + e^{\alpha + \beta X}]^2}$$

$$(12)\quad \frac{\partial R}{\partial X} = \frac{\beta e^{\alpha + \beta X}}{[1 + e^{\alpha + \beta X}]^2} = \frac{\beta\ R}{1 + e^{\alpha + \beta X}} = \beta . R . (1 - R)$$

Since $(1 - R) = 1 - \dfrac{e^{\alpha + \beta X}}{1 + e^{\alpha + \beta X}} = \dfrac{1}{1 + e^{\alpha + \beta X}}$

Substituting Equation (12) into Equation (1), we obtain the elasticity as:

$$(13)\quad \frac{\partial R}{\partial X} \cdot \frac{\overline{X}}{\overline{R}} = \frac{\beta\ R}{(1 - R)} \cdot \frac{\overline{X}}{\overline{R}}$$

Assuming that R is evaluated at its mean value $\overline{R}$, we can cancel R and $\overline{R}$ in Equation (13) and obtain the formula for the reenlistment elasticity (R_e) as:

$$(14)\quad R_e = \beta\ (1 - R)\ \overline{X}$$

where β is the Beta coefficient estimated as a regression coefficient in the logit program, (1 - R) is the average probability to separate from the Army in a particular occupational group (MOS), and $\overline{X}$ is an average value of the relevant independent variable such as the SRB, RMC/W, etc.

APPENDIX B

DATA DEVELOPMENT

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Civilian Data

The 1979-81 youth cohort of the National Longitudinal Surveys (NLS) is the data set used in constructing variables for the civilian earnings equation. The NLS consists of approximately 12,000 individuals in the age group 14 to 22 when interviewed. We sorted males in the age cohort 19 to 22 because their labor market experience was comparable with male enlisted servicemen who were on the verge of completing their first-term enlistment of about four years at an average age of 21 to 22 years. In order to increase the comparability with enlisted personnel, we also excluded individuals who were either full-time students or part-time workers (working less than 35 hours per week) and those who earned less than $1,000 in 1981. Moreover, workers with four-year college degrees were excluded (because only one percent of enlisted personnel had college degrees in FY 1981), but those with two years of college education were included in our sample. These restrictions, together with the exclusion of missing values from the observations, reduced our sample size from 12,000 to 1,837.

The manipulation of the NLS data tapes included cross-referencing thousands of questions or reference numbers. For example, reference number 6,468 provided 1981 unemployment rates for the labor market of current residence. Because these rates were presented for class groups (i.e. less than 3%, 3 to 5.9%, 6 to 8.9%, etc.), we chose the mid point of each class. This assumption permitted relating unemployment rates of local areas of residence of the individual with other corresponding variables such as civilian wages, education, and experience.

In some cases, we had to combine two variables and their corresponding reference numbers in order to develop a single variable required for the model. For example appropriate multipliers were used to calculate annual earnings. If wages were reported on an hourly basis, then annual earnings would be the product of the hourly wage rate times hours worked per week times weeks worked per year. The relevant reference or question numbers used to calculate annual earnings were 5,465 and 5,466. Similarly, total work experience (in weeks) of a youth was traced to previous years. In this context, the NLS database is extremely useful because it permits tracing the longitudinal experience of an individual to several past years. We limited the work histories of our observations to 1979 only because the relatively young cohort relevant for our analysis did not have longer work experience. The 'experience' variable was developed from the information on the number of weeks worked in the years 1979, 1980, and 1981.

'Full-time' employment was defined to be 35 'usual hours per week' or more. Our sort was based on reference numbers 5455, 5456 and 5457.

Army Data

The basic source for constructing the military variables was the Defense Manpower Data Center's (DMDC) Enlistment Master Files for FY 1980 (EMF80) and FY 1981 (EMF81). Because the EMFs contain records of enlistees, they are not directly useful for providing information on reenlistees. In order to determine the number of individuals who were eligible for reenlistment (i.e. at the decision point of either reenlisting or separating from the Army) we developed three separate files. The GAIN file was defined to include new enlistees (non-prior service accessions), reenlistees, and prior service accessions who had broken time service periods and had decided to rejoin the Army in FY 1981. This GAIN file was generated by matching the social security numbers of servicemen in EMF81 with the servicemen in EMF80 and retaining only those servicemen

included in EMF81 but did not exist in EMF80. The LOSS file included servicemen who had decided to separate from the Army in FY81. This file was developed by matching the social security numbers of servicemen in EMF81 with those in EMF80 and retaining only those records that existed in EMF80 and not in EMF81. In short, the LOSS file included servicemen who were on the active duty in FY80 but had decided to quit the Army in FY81. The third file, called the MATCH file, was developed by matching the social security numbers of the servicemen in the GAIN file and those who were not on the LOSS file. In effect, this file included those sevicemen on active duty in both FY80 and FY81 who had decided to reenlist for three or more years. Although the MATCH file also included extendees, they are not entitled to the selective reenlistment bonus (SRB) and were excluded from the analysis. Among the reenlistees, we sorted only those in Zone A, that is, those who decided to reenlist for a period of three to six years. This period was determined from the information on their ETS (Expiration of Term of Service) dates on the GAIN file. The reenlistees were also sorted to include those who were eligible for reenlistment. The eligibles were determined to be those who were rated 1, 1A, 1B, 2, 2A, 2B, and 2C; servicemen with rating values 3 and 4 were excluded from the eligibles. The rating values selected for determining eligibles comprised of servicemen who (1) had the required length of service, (2) were tested for their primary MOS, or (3) had a score of 90 or above in any three or more aptitude test areas. Reenlistees included those who had made their decisions to reenlist during the 'open window' period of between the 27th and 36th month of service, were in the paygrade E3 or higher, and were in the same MOS (no migration). The reenlistment term was calculated from the information on the date of latest enlistment/reelistment of service and the ETS by subtracting the former from the latter.

Since the MATCH file included information on all MOS, the file was sorted to include only those in which a SRB was paid in FY81. These MOS were then combined into

career management fields (CMF) shown in Appendix Table 1. The micro level data for each eligible soldier on such variables as basic pay, race, mental category, civilian education, military grade, marital status, *number of dependents*, total active federal military service, and age were collected by matching the social security numbers of the servicemen.

APPENDIX TABLE 1

MILITARY OCCUPATIONAL SPECIALITIES (MOS) AND THE CAREER MANAGEMENT FIELDS (CMF)

Number	MOS Number	MOS Description	CMF Number
1	05D	EW/SIGINT Ident/Loc.	98
2	05G	SIGSEC Specialist	98
3	05H	EW/SIGINT Morse Interceptor-IMC	98
4	05K	EW/SIGINT NMors Interceptor	98
5	11B	Infantryman	11
6	11C	Indirect fire infantryman	11
7	11H	Heavy antiarmor wpns infantryman	11
8	12B	Combat engineer	12
9	12C	Bridge crewman	12
10	12E	ADM (Atomic demol mun) spec	12
11	12F	Engr TRVEH (tracked veh) crewman	12
12	13B	Cannon crewman	13
13	13C	TACFIRE Opns Spec	13
14	13E	Cannon FD (fire dir) spec	13
15	13F	Fire support spec	13
16	13R	Firefinder radar opr	13
17	15D	Lance missile crew mbr/MLRS Sgt	13
18	15E	PERSHING missile crew mbr	13
19	15J	MLRS/LANCE op/fire dir spec	13
20	16B	HERCULES missile crew mbr	16
21	16C	HERCULES fire control crew mbr	16
22	16D	HAWK missile crew mbr	16
23	16E	HAWK fire control crew mbr	16
24	16R	ADA Short Range Gunnery crewman	16
25	19D	Cavalry scout	19
26	19E	M48-M60 armor crewman	19
27	19F	MR8/60 tank driver	19
28	19G	Armor recon veh crewman	19
29	19H	Armor recon veh crewman	19
30	19J	M60A2 armor crewman	19
31	19K	XMI armor crewman	19
32	24E	IH fire control mech	23
33	24G	IH (info) coordinator Cen Mech	23
34	24H	IH fire control repairer	23
35	24K	IH CW radar repairer	23
36	24N	CHAPPARAL sys mech	27
37	24U	HERCULES elect mech	23
38	26B	Wpns Spt Rdr Rprr	29
39	26E	Aerl survival sensor rprr	28

APPENDIX TABLE 1 (Continued)

MILITARY OCCUPATIONAL SPECIALITIES (MOS) AND THE CAREER MANAGEMENT FIELDS (CMF)

Number	MOS Number	MOS Description	CMF Number
40	26Q	Tac microwave sat sys opr	31
41	26R	Strtgc microwave sat sys opr	31
42	26V	Strtgc microwave sys rprr	29
43	26Y	SATCOM equip rep	29
44	27E	TOW/DRAGON rprr	27
45	27F	VULCAN repairer	27
46	27G	CHAPARRAL/REDEYE rprr	27
47	27N	FAAR rep	27
48	31J	Teletypewriter rep	29
49	31S	Field gen COMSEC rep	29
50	31T	Field sys COMSEC rep	29
51	31V	Tac comm sys op/mech	31
52	32D	Statn tech controller	31
53	32F	Fixed ciphony rep	29
54	35H	Calibration specialist	29
55	35L	Avionic comm equip rprr	28
56	35M	Avionic Nav/flt con eq rprr	28
57	35R	Avionic special equip rprr	28
58	35U	Biomed Equip Sp Adv	91
59	36K	Tac wire op sp	31
60	36L	Elect switching sys rep	29
61	44E	Machinist	63
62	45D	SPFA (Field Artillery) turret mech	63
63	45E	M1 ABRAMS turret mech	63
64	45G	FC systems rep	63
65	45K	Tank reprr	63
66	45N	M60A1/A3 turret mech	63
67	45T	Itv/ifv/cfv turret mech	63
68	63B	Lt wt veh & pwr gen mech	63
69	63D	Sp FA system mech	63
70	63E	M1 ABRAMS tank sys mech	63
71	63N	M60A1/A3 tank sys mech	63
72	63S	Hvy wheel veh mech	63
73	63T	ITV/IFV/CFV sys mech	63
74	63Y	Track veh mech	63
75	91B	Medical specialist	91
76	91C	Patient care specialist	91
77	91D	Operating room specialist	91
78	91F	Psychiatric specialist	91

APPENDIX TABLE 1 (Continued)

MILITARY OCCUPATIONAL SPECIALITIES (MOS) AND THE CAREER MANAGEMENT FIELDS (CMF)

Number	MOS Number	MOS Description	CMF Number
79	91G	*Behavioral science specialist*	91
80	91H	Orthopedic specialist	91
81	91J	Physical therapy specialist	91
82	91Q	Pharmacy specialist	91
83	91R	Veterinary specialist	91
84	91S	Environmental health specialist	91
85	91U	ENT specialist	91
86	91V	Respiratory specialist	91
87	91W	Nuclear med specialist	91
88	93F	FA met crew mbr	13
89	93H	ATC tower operator	64
90	93J	ATC radar controller	64
91	96B	Intelligence analyst	96
92	96C	Interrogator	96
93	96D	Image interpreter	96
94	96H	Aer SNS Sp OV--ID	96
95	97B	CI (Central Intelligence) agent	96
96	98C	EW/SIGINT analyst	98
97	98G	EW/SIGINT voice intep	98
98	98J	EW/SIGINT NC (Non Com) intecp	98

APPENDIX TABLE 2

AVERAGE FIRST TERM SRB PAYMENTS FOR MAJOR MOS,[1] FY 1981

Number	MOS	Description	SRB Payment Amount ($000)	Number of Payments	Average SRB Payment ($)
1	11B	Infantryman	$14,167	2,465	$5,747
2	13B	Cannon Crewman	8,539	1,438	5,938
3	11C	Indirect Fire Infantryman	4,268	735	5,806
4	12B	Combat Engineer	3,968	742	5,348
5	54E	NBC Specialist	2,960	286	10,349
6	36K	Tac Wire Op Sp	2,864	830	3,451
7	91B	Medical Specialist	2,446	709	3,168
8	19E	M48-M60 Armor Crewman	2,246	651	3,450
9	11H	Hv Anti-armor Wpn Infantryman	2,232	378	5,905
10	63B	Lt Wt Veh & Pwr Gen Mech	1,808	524	3,450
11	19D	Cavalry Scout	1,480	429	3,450
12	63T	ITV/IFV/CFV Sys Mech	1,380	230	6,000
13	13E	Cannon FD Specialist	1,235	215	5,744
14	98G	EW/SIGINT Voice Intep	1,177	85	13,847
15	05H	EW/SIGINT Intep-IMC	1,128	109	10,349
16	63N	M60A1/A3 Tank Sys Mech	1,107	179	6,184
17	13F	Fire Support Specialist	1,001	115	8,704
18	91C	Patient Care Specialist	976	283	3,449
19	19F	M48-M60 Tank Driver	887	257	3,451
20	98C	EW/SIGINT Analyst	842	69	12,203

APPENDIX TABLE 2 (Continued)

AVERAGE FIRST TERM SRB PAYMENTS FOR MAJOR MOS,[1] FY 1981

Number	MOS	Description	SRB Payment Amount ($000)	Number of Payments	Average SRB Payment ($)
21	12E	ADM Spec	842	61	13,803
22	15E	PERSHING Missile Cmbr	814	118	6,898
23	33S	EW/Intep Sys Rep	754	54	13,963
24	05K	EW/SIGINT NM Intep	705	50	14,100
25	72G	Auto Data Telecom Cen Op	700	203	3,448
26	63D	SP FA System Mechanic	593	77	7,701
27	15D	LANCE/Crmbr/MLRS Sgt	569	103	5,524
28	31V	Tac Comm Sys Op/Mech	559	162	3,405
29	63Y	Track Veh Mech	552	160	3,450
30	16R	ADA Short Rg Gnry Crewman	552	87	6,345
31	12C	Bridge Crewman	538	94	5,723
32	16D	HAWK Missile Cmbr	538	156	3,448
33	55B	Ammunition Specialist	511	148	3,453

[1] Defined as receiving over $0.5 million in FY 1981.

Source: Military Personnel Center.

APPENDIX TABLE 3

LOGISTIC REGRESSIONS FOR REENLISTMENT PROBABILITIES, EXCLUDING UNEMPLOYMENT, FOR CMF, FY 1981

(Chi-square Statistics are in Parentheses)

				Beta Coefficients For:					
Equation	CMF	R^2	Intercept	SRB	RMC/W	CAT	RACE	DEPS	Number of Observations
1	Total	.45	-9.07* (706.14)	0.00021* (748.35)	5.07* (301.80)	2.03* (2944.32)	1.76* (936.75)	0.66* (804.00)	28,161
2	11	.40	-11.93* (274.25)	0.00026* (240.50)	7.43* (149.60)	1.86* (639.96)	1.17* (259.76)	0.69* (228.48)	6,963
3	12	.54	-8.62* (40.08)	0.00018* (41.55)	3.96* (11.60)	3.08* (206.51)	1.63* (71.47)	0.67* (43.92)	1,895
4	13	.48	-11.95* (162.58)	0.00040* (300.23)	7.09* (79.40)	1.77* (269.14)	1.28* (165.21)	.78* (151.75)	3,520
5	16	.39	-10.97* (39.37)	0.00043* (17.17)	6.72* (20.79)	1.77* (58.75)	1.05* (27.73)	.78* (43.25)	934
6	19	.45	-9.57* (61.78)	0.00036* (133.48)	4.77* (21.38)	2.12* (291.91)	1.23* (84.06)	0.62* (55.48)	2,863
7	23	.70	1.29 (.03)	0.00019 (2.79)	-6.31 (.94)	5.18* (29.84)	1.15 (1.87)	0.59 (1.08)	171
8	27	.51	-8.33 (3.06)	0.00043* (12.68)	3.29 (.64)	2.44* (29.21)	0.58 (1.35)	0.60** (3.46)	252

APPENDIX TABLE 3 (Continued)

LOGISTIC REGRESSIONS FOR REENLISTMENT PROBABILITIES, EXCLUDING UNEMPLOYMENT, FOR CMF, FY 1981

(Chi-square Statistics are in Parentheses)

Equation	CMF No.	R^2	Intercept	SRB	RMC/W	CAT	RACE	DEPS	Number of Observations
				Beta Coefficients For:					
9	28	.63	-4.56 (.31)	0.00056* (8.71)	-1.23 (.03)	4.22* (15.76)	1.34 (1.60)	0.73 (2.05)	67
10	29	.62	-8.27* (6.63)	0.00031* (26.83)	3.42 (1.49)	3.39* (104.45)	2.04* (27.64)	0.22 (1.10)	513
11	31	.50	-11.56* (75.38)	0.0011* (149.42)	5.61* (23.58)	1.84* (133.44)	1.08* (58.57)	0.67* (57.71)	2,179
12	63	.40	-10.06* (116.59)	0.00027* (150.95)	5.84* (52.24)	1.69* (233.73)	1.00* (74.22)	0.82* (152.40)	4,287
13	64	.66	-1.12 (.09)	0.00024* (12.89)	-2.91 (.81)	3.56* (4.94)	1.13* (4.94)	0.62* (6.09)	303
14	91	.55	-4.83* (17.07)	0.00051* (90.09)	0.14 (.02)	2.85* (469.20)	0.97* (48.83)	0.32* (18.34)	2,828
15	96	.62	-10.64* (11.43)	0.00039* (17.40)	5.03** (3.71)	3.64* (69.07)	2.45* (16.48)	0.48* (6.37)	328
16	98	.65	-5.02* (11.63)	0.000093* (13.88)	0.82 (.43)	3.77* (238.05)	0.46 (23.5)	0.33* (5.99)	1,028

* Significant at the 0.01 level.

** Significant at the 0.05 level.